



## Course Outline

# MCR3U – Functions, 11

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**Course Code:** MCR3U  
**Course Name:** Functions  
**Grade:** 11  
**Course Type:** University  
**Credit Value:** 1.0

**School Name:** Salvador Academy  
**Department:** Mathematics  
**Department Head:** Mario Salvador  
**Development:** 2017 by Mario Salvador  
**Revision:** 2017 by Mario Salvador

**Curriculum Policy Document:** Mathematics, The Ontario Curriculum, Grades 11 and 12, 2007

**Prerequisite:** MPM2D, Principles of Mathematics, Grade 10, Academic

### Course Description/Rationale

This course introduces the mathematical concept of the function by extending students' experiences with linear and quadratic relations. Students will investigate properties of discrete and continuous functions, including trigonometric and exponential functions; represent functions numerically, algebraically, and graphically; solve problems involving applications of functions; investigate inverse functions; and develop facility in determining equivalent algebraic expressions. Students will reason mathematically and communicate their thinking as they solve multi-step problems.

### Overall Curriculum Expectations

By the end of this course, students will:

#### A. Characteristics of Functions

A1. demonstrate an understanding of functions, their representations, and their inverses, and make connections between the algebraic and graphical representations of functions using transformations;  
A2. determine the zeros and the maximum or minimum of a quadratic function, and solve problems involving quadratic functions, including problems arising from real-world applications;  
A3. demonstrate an understanding of equivalence as it relates to simplifying polynomial, radical, and rational expressions.

#### B. Exponential Functions

B1. evaluate powers with rational exponents, simplify expressions containing exponents, and describe properties of exponential functions represented in a variety of ways;  
B2. make connections between the numeric, graphical, and algebraic representations of exponential functions;

B3. identify and represent exponential functions, and solve problems involving exponential functions, including problems arising from real-world applications.

### **C. Discrete Functions**

C1. demonstrate an understanding of recursive sequences, represent recursive sequences in a variety of ways, and make connections to Pascal's triangle;

C2. demonstrate an understanding of the relationships involved in arithmetic and geometric sequences and series, and solve related problems;

C3. make connections between sequences, series, and financial applications, and solve problems involving compound interest and ordinary annuities.

### **D. Trigonometric Functions**

D1. determine the values of the trigonometric ratios for angles less than  $360^\circ$ ; prove simple trigonometric identities; and solve problems using the primary trigonometric ratios, the sine law, and the cosine law;

D2. demonstrate an understanding of periodic relationships and sinusoidal functions, and make connections between the numeric, graphical, and algebraic representations of sinusoidal functions;

D3. identify and represent sinusoidal functions, and solve problems involving sinusoidal functions, including problems arising from real-world applications.

## **Outline of Course Content**

### Course Units

Unit 1 – Basic Algebraic Concepts (16 Hours)

Unit 2 – Quadratics (14 Hours)

Unit 3 – Functions and their Properties (10 Hours)

Unit 4 – Exponential Functions (12 Hours)

Unit 5 – Discrete Functions and Math of Finance (16 Hours)

Unit 6 – Trigonometry (10 Hours)

Unit 7 – Trigonometric Expressions (13 Hours)

Unit 8 – Trigonometric Functions (15 Hours)

Final Exam (3 Hours)

## **Teaching and Learning Strategies**

Each course is broken into eight to ten units that each consist of three to six modules. Each module begins with a review of prerequisite skills and ensures mastery of these skills to start learning new material. Through competency-based learning, each course encourages mastery of individual skills/learning outcomes. Learners will work one competency at a time in order to complete learning goals of the course. Learners will have be given opportunities to refine their skills and deepen their understanding without advancing to more abstract material. Teachers will identify when a student is struggling on particular concepts and facilitate appropriate instruction and activity to help the student overcome obstacles.

All modules are carefully scaffolded so that students can effectively tackle abstract problems and apply their understanding to real-life applications the end of the unit. At the end of each module is

an assignment where no solutions are given as they are to be submitted for assessment. As well, the unit will conclude with a test. Both the assignment and the test for each module will contribute to the student's grade.

Teachers and administrators will help students to enjoy learning and encourage them to take control of their learning process by learning independently and taking risks without a fear of failure. Teachers will ask more questions than give answers so students can arrive at answers on their own through investigation and reasoning. Through competency-based learning, students will become more confident with math after achieving mastery of smaller goals and skills.

Various instructional strategies will to meet a range of learning needs and accommodate different learning styles, interests and abilities. All learning activities will take into consideration seven mathematical processes:

- **Communicating:** To improve student success there will be several opportunities for students to share their understanding both in oral as well as written form.
- **Problem solving:** Scaffolding of knowledge, detecting patterns, making and justifying conjectures, guiding students as they apply their chosen strategy, directing students to use multiple strategies to solve the same problem, when appropriate, recognizing, encouraging, and applauding perseverance, discussing the relative merits of different strategies for specific types of problems.
- **Reasoning and proving:** Asking questions that get students to hypothesize, providing students with one or more numerical examples that parallel these with the generalization and describing their thinking in more detail.
- **Reflecting:** Modeling the reflective process, asking students how they know.
- **Selecting Tools and Computational Strategies:** Modeling the use of tools and having students use technology to help solve problems.
- **Connecting:** Activating prior knowledge when introducing a new concept in order to make a smooth connection between previous learning and new concepts, and introducing skills in context to make connections between particular manipulations and problems that require them.
- **Representing:** Modeling various ways to demonstrate understanding, posing questions that require students to use different representations as they are working at each level of conceptual development - concrete, visual or symbolic, allowing individual students the time they need to solidify their understanding at each conceptual stage.

### **Strategies for Assessment & Evaluation of Student Performance**

We follow the leadership of the Ministry of Education in regards to Assessment and Evaluation as outlined in *Growing Success, 2010*. It details that the primary purpose of assessment and evaluation is to improve student learning. Salvador Academy will use assessment to ensure mastery of necessary skills, build confidence in students and to develop self-assessment skills and metacognitive skills.

In accordance with *Growing Success*, teachers will use practices and procedures that:

- 1) are fair, transparent, and equitable for all students;
- 2) support all students, including those with special education needs, those who are learning the language of instruction (English or French), and those who are First Nation, Métis, or Inuit;

- 3) are carefully planned to relate to the curriculum expectations and learning goals and, as much as possible, to the interests, learning styles and preferences, needs, and experiences of all students;
- 4) are communicated clearly to students and parents at the beginning of the school year or course and at the appropriate points through the school year or course;
- 5) are ongoing, varied in nature, and administered over a period of time to provide multiple opportunities for students to demonstrate the full range of their learning;
- 6) provide ongoing descriptive feedback that is clear, specific, meaningful, and timely to support improved learning and achievement
- 7) develop students' self-assessment skills to enable them to assess their own learning, set specific goals, and plan next steps for their learning

Achievement in this course will consider four categories:

- Knowledge and Understanding: subject-specific content acquired in each course (knowledge), and the comprehension of its meaning and significance (understanding).
- Thinking: the use of critical and creative thinking skills and/or processes such as: planning skills, processing skills and critical/creative thinking processes.
- Communication: the conveying of meaning through various oral, written, and visual forms
- Application: the use of knowledge and skills to make connections within and between various contexts.

70% of the grade will be based on evaluations conducted through the course. 30% of the grade will be based on a final exam to be completed at the end of the course. A final grade is recorded for this course, and a credit is granted, if the student's grade is 50% or higher.

A midterm report card will be issued after completion of half of the modules in the course. A final report card will be issued after completion of the entire course. Student achievement of the curriculum expectations will be reported as a percentage grade. The report card will also contain the course median grade (as a percentage) and letter grades for six learning skills:

- Responsibility
- Organization
- Independent Work
- Collaboration
- Initiative
- Self-Regulation

A final report card will be sent to the student's home school to be added to the student's transcript of completed OSSD credits.

### **Considerations for Program Planning**

Considerations are made when planning this course and efforts are made to align with the Ministry of Education policies and initiatives:

### **Planning Related to Students with Special Needs**

Teachers have a responsibility to help all students learn and succeed. Accommodations can support each student's unique style of learning. For those with special education needs, teachers and administrators, in conjunction with the student, parent and any recommendations from a board designated Individual Education Plan (IEP), will determine whether it is appropriate to make accommodations or modify expectations. Accommodations may include instructional modifications, environmental accommodations or assessment accommodations.

### **Program Considerations for English Language Learners**

Teachers have a responsibility to help all students learn and succeed. Students whose first language is not English may come from regions with highly sophisticated educational systems or regions where formal school was limited. Teachers share in the responsibility for their English-language development and can give necessary support in a variety of methods.

### **Antidiscrimination Education in Mathematics**

Teachers have a responsibility to help all students learn and succeed. To ensure that all students in the province have an equal opportunity to achieve their full potential, the curriculum must be free from bias, and all students must be provided with a safe and secure environment, characterized by respect for others, that allows them to participate fully and responsibly in the educational experience. Teachers will facilitate a learning environment that is inclusive in nature and the curriculum should be enriched the diverse experiences of students with varying backgrounds, abilities, interests, and learning styles. It is our philosophy that this can be more easily achieved when mathematics is viewed in real-life contexts whether through analysis of data trends or solving problems in health, science and the environment.

### **Literacy/Inquiry Research Skills**

Teachers have a responsibility to help all students learn and succeed. We advance a student's development by helping them to learn skills such as literacy and inquiry research skills. Achievement in communication is important in mathematics in writing, orally or visually. Teachers will help students be precise in mathematical terminology. It is also important that teachers develop a student's ability to ask questions and plan investigations when solving problems in an effort to deepen the learner's understanding.

### **The Role of Information and Communication Technology in Mathematics**

Teachers will engage students in many information and communication technologies (ICT) to support a student's learning of mathematics. This will include, but not limited to, simulations, multimedia, online portals, graphing technologies, databases, spreadsheets, word-processing software, computer algebra systems (CAS).

### **Career Education**

Teachers have a responsibility to help all students learn and succeed. Mathematics is more enjoyable when students explore concepts that are career-related and connections are made to each student's interests, aspirations and abilities. The curriculum will emphasize the usefulness of math in various

fields such as science, business, engineering, computer studies; industries such as hospitality, recreation, and tourism; and in the technical trades.

### **Health and Safety in Mathematics**

It is paramount that we provide a safe learning environment and that all classroom practice complies with relevant federal, provincial, and municipal health and safety legislation and by-laws, including, but not limited to, the Workplace Safety and Insurance Act, the Workplace Hazardous Materials Information System (WHMIS), the Food and Drug Act, the Health Protection and Promotion Act, the Ontario Building Code, and the Occupational Health and Safety Act (OHSA). The OHSA requires all schools to provide a safe and productive learning and work environment for both students and employees.

### **Resources**

Casio fx-991ES Plus C Calculator  
Scanner or camera to upload work  
\*Textbook not required.